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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/673,646	09/30/2003	Hideaki Yamasaki	071469-0305915	1161
909	7590	09/22/2004	EXAMINER	
PILLSBURY WINTHROP, LLP			NGUYEN, THANH T	
P.O. BOX 10500			ART UNIT	
MCLEAN, VA 22102			PAPER NUMBER	
			2813	

DATE MAILED: 09/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/673,646

Applicant(s)

YAMASAKI ET AL.

Examiner

Thanh T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) 1-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 2/18/04.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_.

## **DETAILED ACTION**

### ***Information Disclosure Statement***

The information disclosure statement filed on 2/18/04 has been considered.

### ***Oath/Declaration***

Oath/Declaration filed on 2/18/04 has been considered.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 6-8, 11-14, 17-19, 33-36, and 39 are rejected under 35 U.S.C. 102(e) as being anticipated by Lai et al. (U.S. Publication No. 2004/0014315).

Referring to figure 6-11, Lai et al. teaches a method of forming a metal layer on a substrate, the method comprising:

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Providing a substrate (see step 502, figure 6, paragraph# 53);

Exposing the substrate to a reducing gas (see paragraph #54);

Exposing the substrate to a pulse of metal-carbonyl precursor (see paragraph# 55),

thereby forming a metal layer (tungsten, see paragraph# 53); and

Repeating the exposing process until a metal layer with a desired thickness is formed (see figure 6, step 510, paragraph# 66).

Regarding to claims 2, 4, the metal-carbonyl precursor ( $W(CO)_6$ ) (see paragraph# 55).

Regarding to claim 3, the metal layer tungsten (W) (see paragraph# 53).

Regarding to claim 6-8, the metal-carbonyl precursor gas comprising at least one of a carrier gas and a dilution gas (see paragraph# 54).

Regarding to claims 11, 13-14, the reducing gas comprising a hydrogen-containing gas, a silicon-containing gas, a boron-containing gas, and a nitrogen-containing gas (see paragraph# 57).

Regarding to claim 12, reducing gas ( $H_2$ ) (see paragraph# 54).

Regarding to claims 17-19, a purge gas to the substrate (see paragraph# 54).

Regarding to claim 33, a semiconductor substrate (Silicon, see paragraph# 53).

Regarding to claim 34, depositing a metal nucleation layer on the substrate (see paragraph# 53).

Regarding to claim 35, depositing comprising a CVD process (see paragraph# 28+).

Regarding to claim 36, depositing utilizes a CVD process comprising exposing the substrate to a metal-carbonyl precursor gas (see paragraph# 28+, and 55+).

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Regarding to claim 39, the substrate comprises plurality of microstructures and the method further comprises:

Forming a metal layer (W) having a first thickness on the bottom of at least one microstructure, a second thickness on the sidewall of at least one microstructure, and an overhang at the top of the at least one microstructure (see figure 11a-11b).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5, 9-10, 13-16, 20-32, 37-38, 40-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lai et al. (U.S. Publication No. 2004/0014315) as applied to claims 1-4, 6-8, 11-14, 17-19, 33-36, and 39 above in view of Pan et al. (U.S. Publication No. 2004/0121596).

Lai et al. teaches all of the limitations as describe in the claimed invention above. However, the references does not teaches the reducing gas is  $\text{NH}_3$ , the flow rate range, the temperature range, the time range, pressure range, and thickness range.

Pan et al. teaches depositing the tungsten film by using tungsten carbonyl ( $\text{W}(\text{CO})_6$ ) and reducing gas  $\text{NH}_3$  (see paragraph#4).

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Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a tungsten layer by using tungsten carbonyl ( $W(CO)_6$ ) and reducing gas  $NH_3$  in process Lai et al. as taught by Pan et al. because the process would provide a desire thickness for a tungsten layer.

The flow rate range, the temperature range, the time range, pressure range, and thickness range are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in *In re Aller*, the selection of reaction parameters such as temperature and concentration would have been obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

*In re Aller* 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any the flow rate range, the temperature range, the time range, pressure range, and thickness range suitable to the method in process of Lai et al. in order to optimize the process.

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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).



Thanh Nguyen  
Patent Examiner  
Patent Examining Group 2800